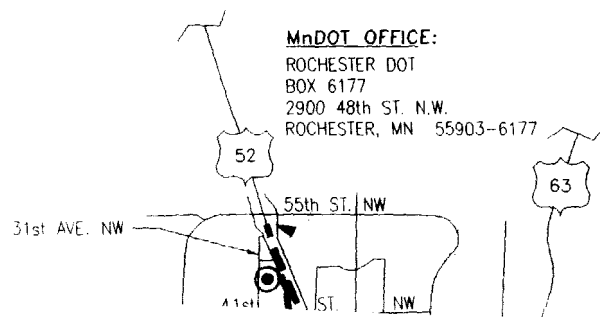


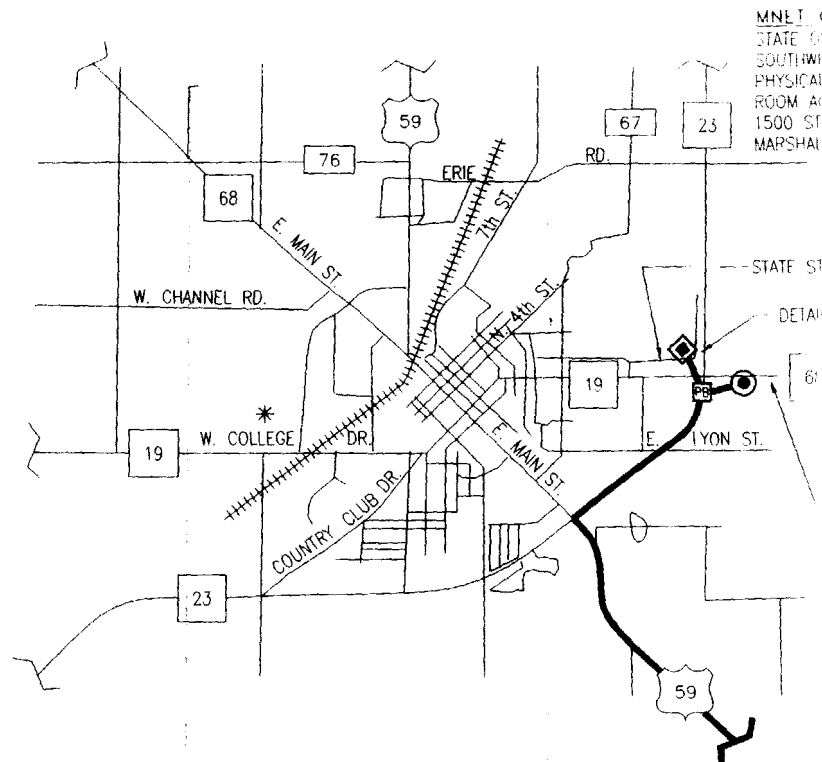
MNET OFFICE:
STATE OF MINNESOTA
MANKATO STATE UNIVERSITY
MORRIS HALL COMPUTER ROOM
SOUTH ROAD & ELLIS AVENUE
MANKATO, MN 56002

MnDOT OFFICE:
MANKATO DOT
P.O. BOX 4039
501 S. VICTORY DRIVE
MANKATO, MN 56001

MANKATO



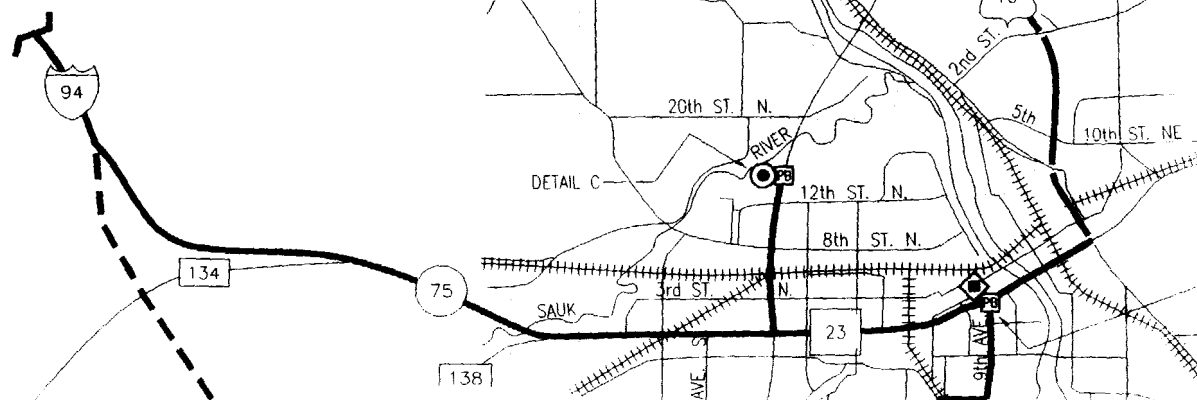
MnDOT OFFICE:
ROCHESTER DOT
BOX 6177
2900 48th ST. N.W.
ROCHESTER, MN 55903-6177

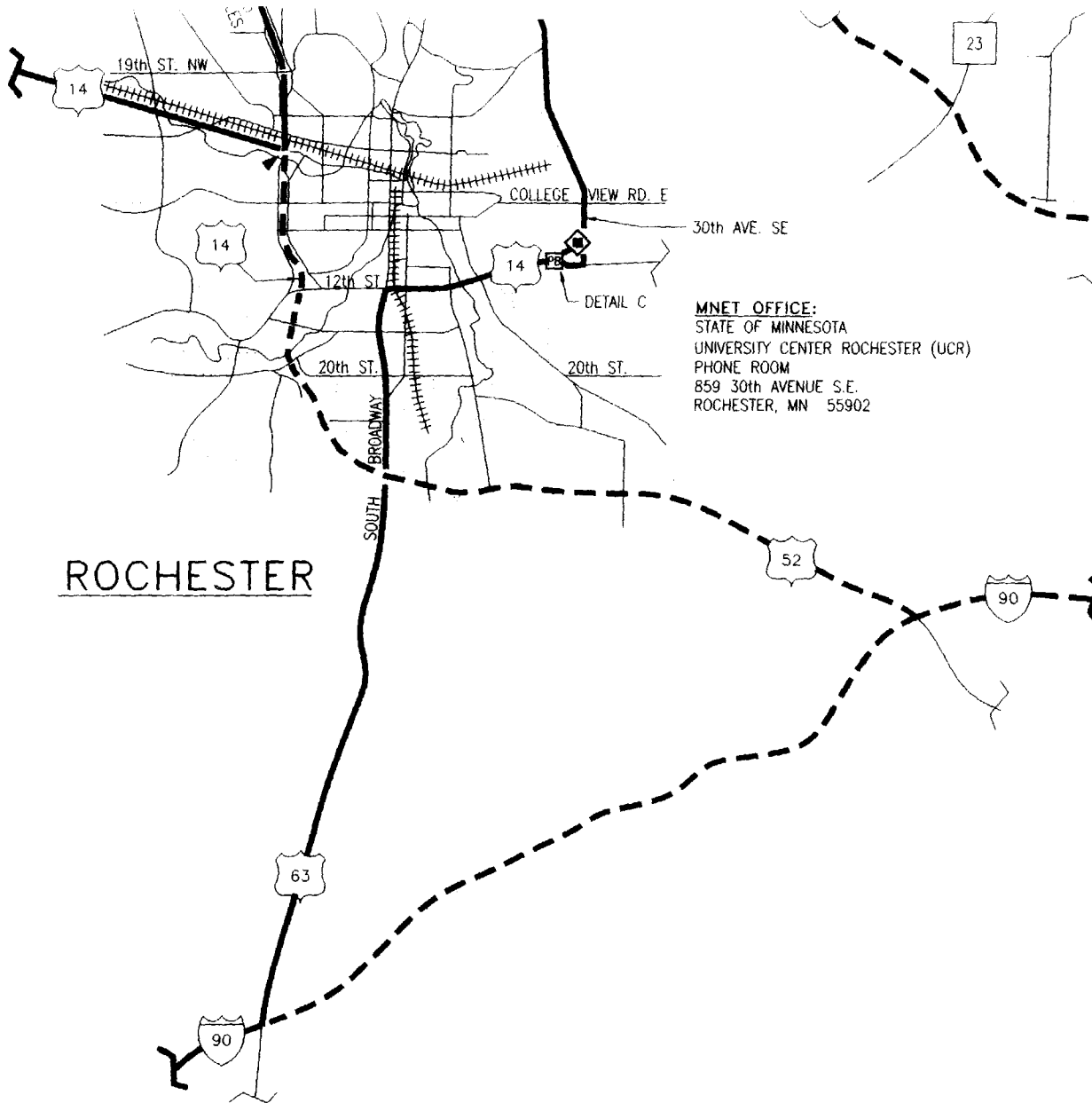


MNET OFFICE:
STATE OF MINNESOTA
SOUTH WYOMING
PHYSICAL ROOM AT
1500 ST. MARSHAL

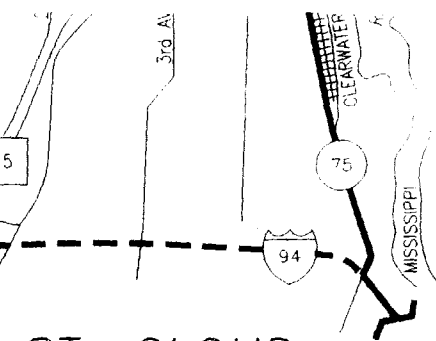
MARSHALL

MnDOT OFFICE:
ST. CLOUD DOT
3725 12th ST. N.
BOX 370
ST. CLOUD, MN 56302



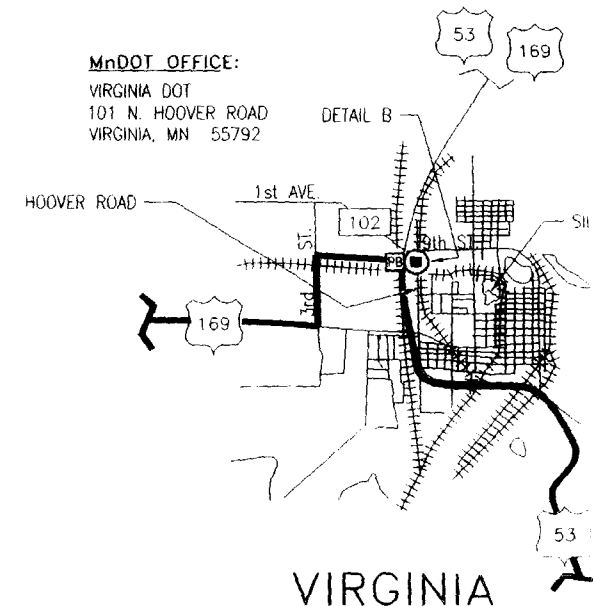


MNET OFFICE:
STATE OF MINNESOTA
UNIVERSITY CENTER ROCHESTER (UCR)
PHONE ROOM
859 30th AVENUE S.E.
ROCHESTER, MN 55902



ST. CLOUD

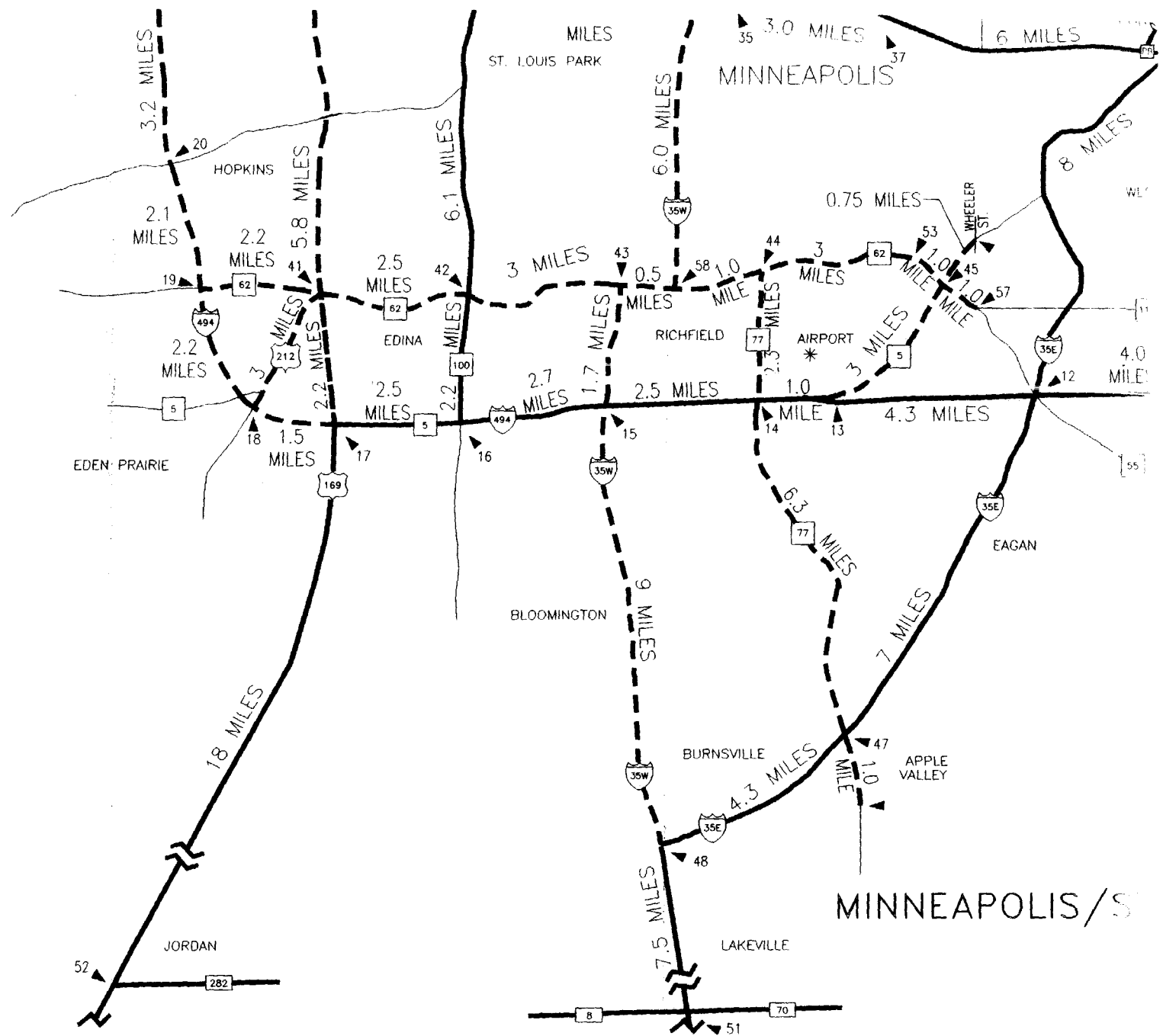
MNET OFFICE:
STATE OF MINN.
ST. CLOUD STA
STUART HALL V.
702 1st AVENUE
ST. CLOUD, MN



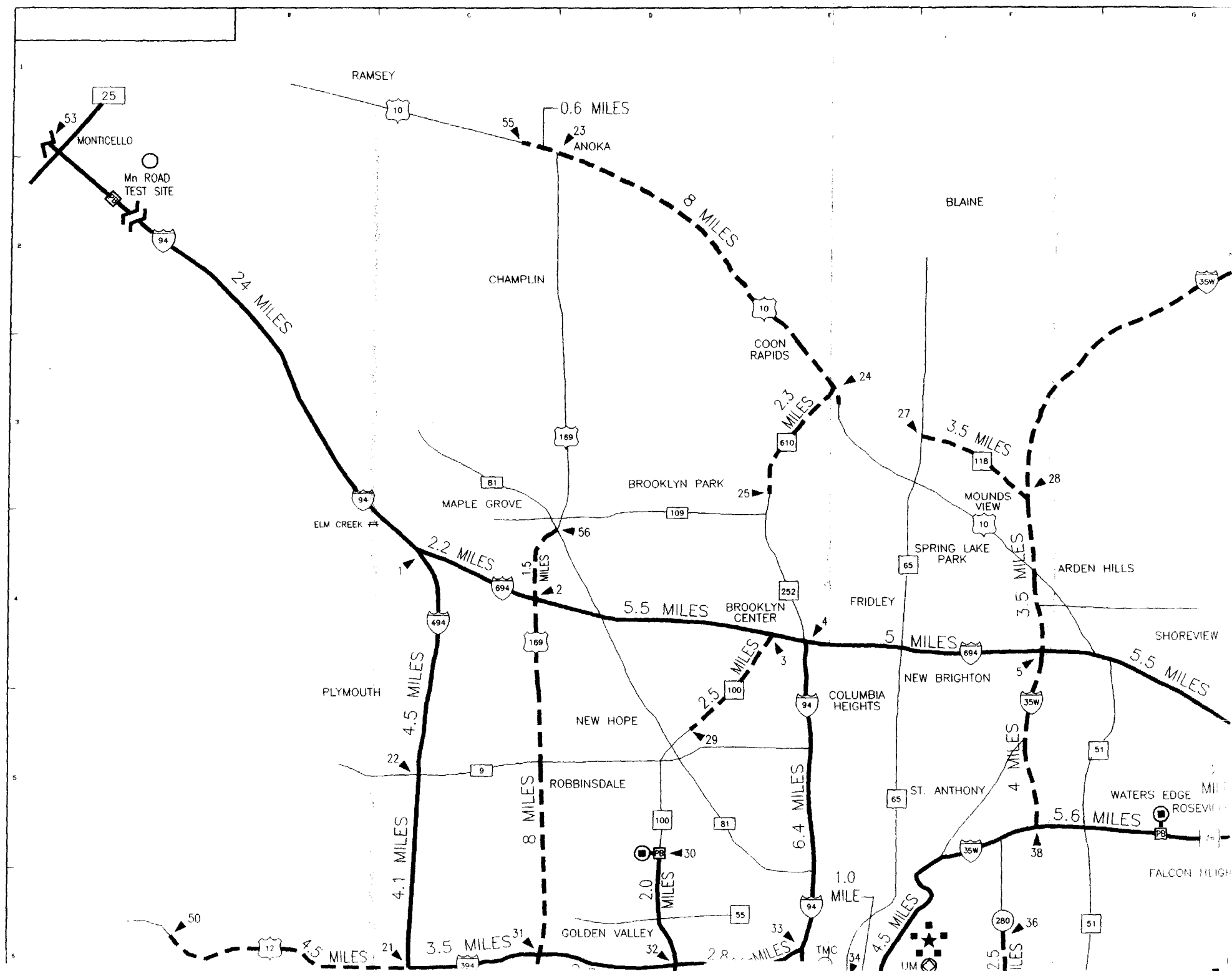
MnDOT OFFICE:
VIRGINIA DOT
101 N. HOOVER ROAD
VIRGINIA, MN 55792

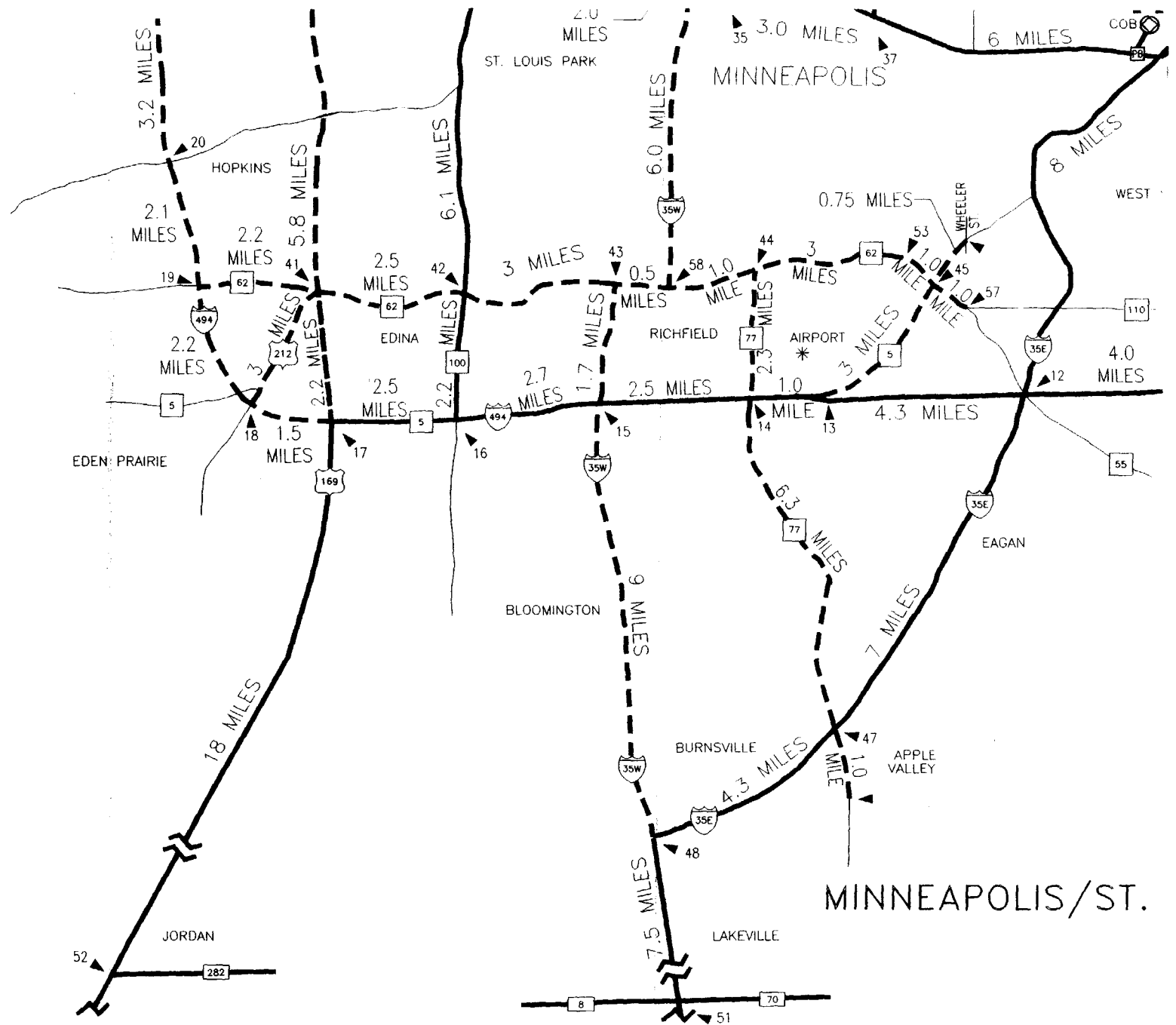
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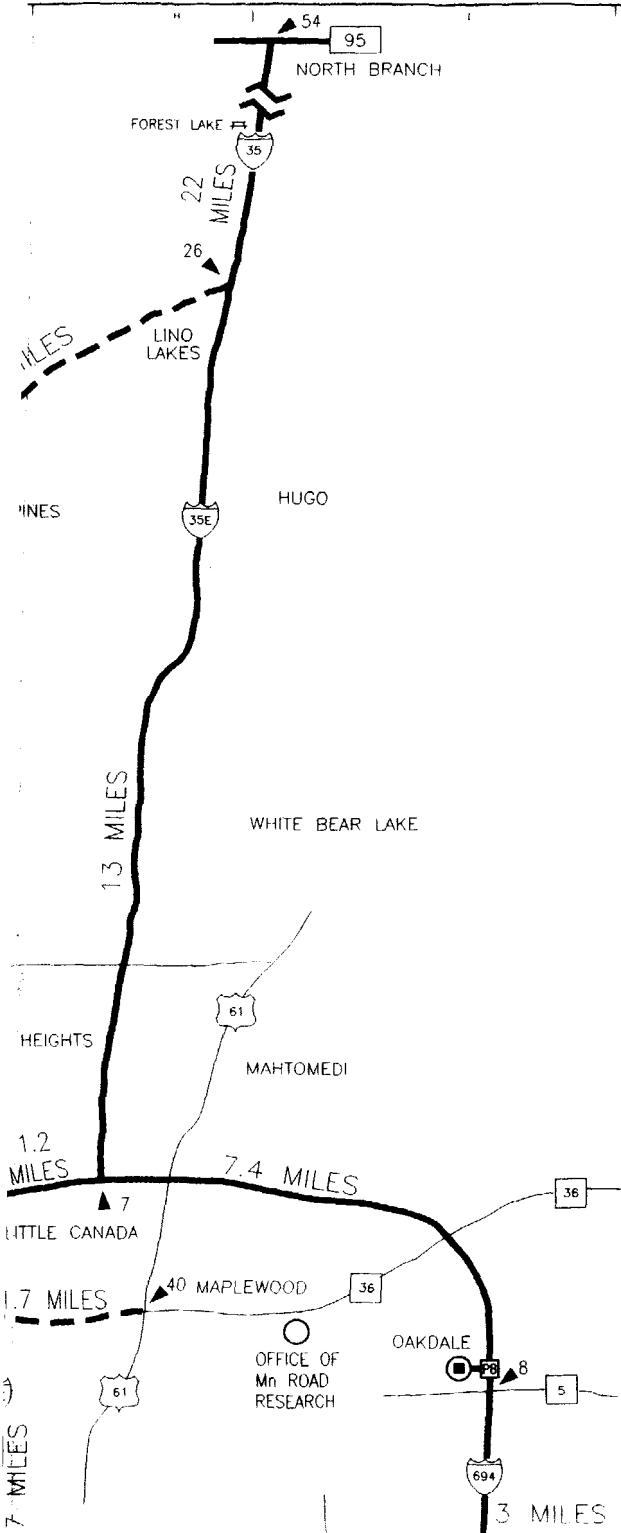


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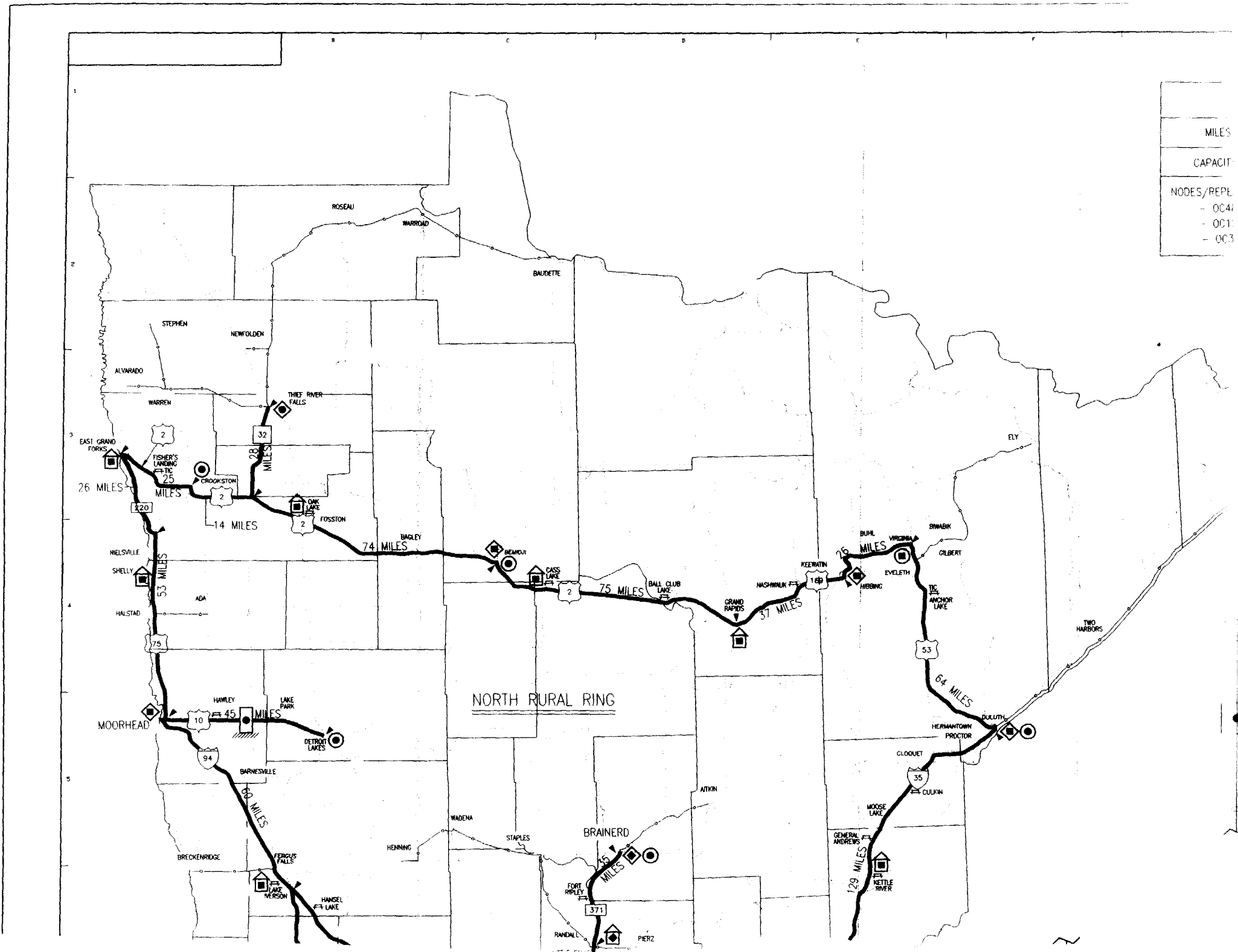


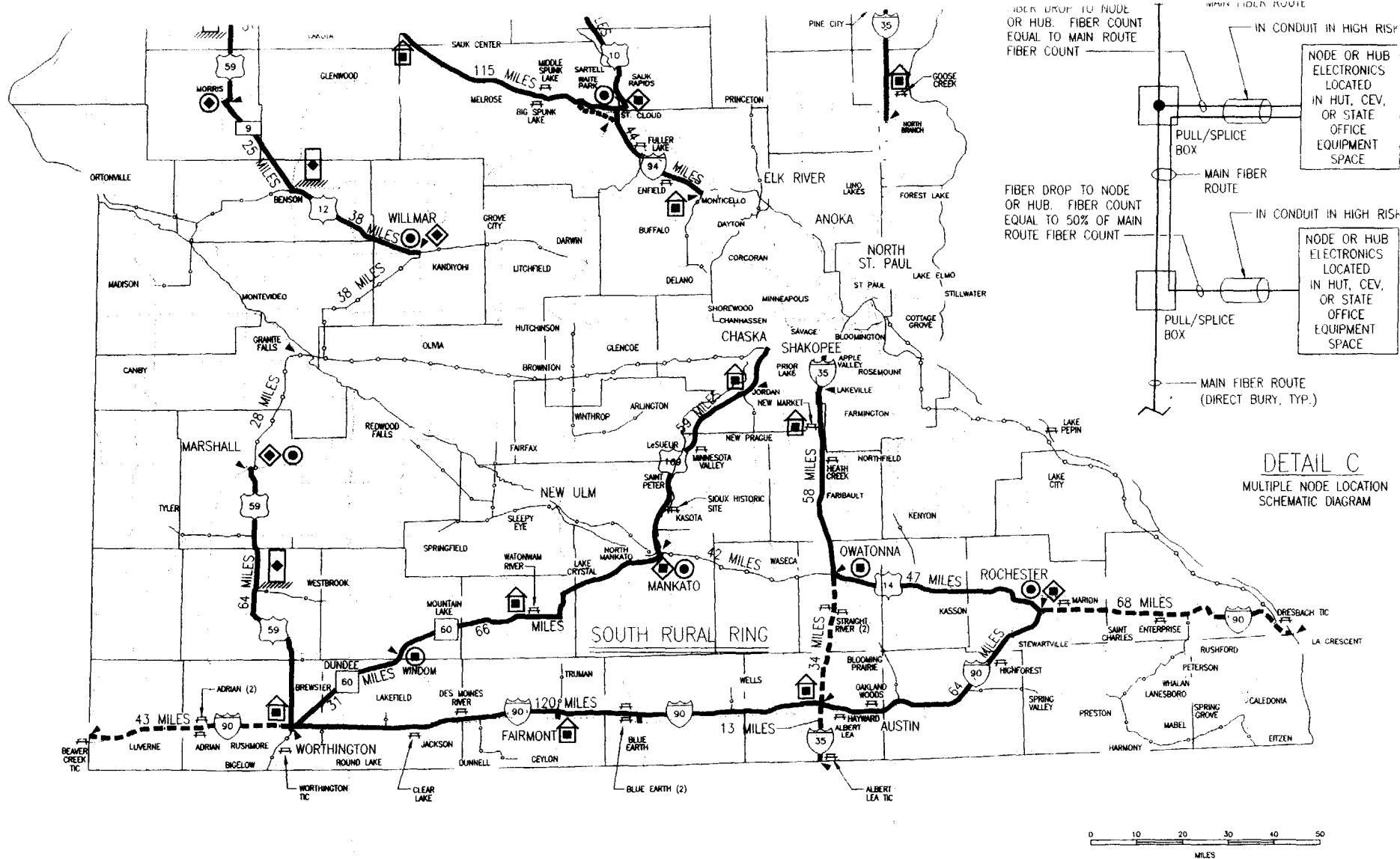
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METRO FIBER DEPLOYMENT SCHEDULE

FROM	TO	ROUTE	MILES		TOTAL FIBER COUNT	STATE FIBER COUNT	NORTH RING	SOUTH RING	METRO RING A	METRO RING B	METRO RING C
			E-ROW	NE-ROW							
1	2	I-694/94	2.2		144	30	48		48	48	
1	22	I-494	4.5		96	20			48	48	
1	53	I-94	24		48	10	48				
2	4	I-694/94	5.5		144	30	48		48	48	
4	5	I-694/94	5		48	10				48	
4	33	I-94	6.4		96	20	48		48		
5	6	I-694/94	5.5		48	10				48	
6	7	I-694/94	1.2		144	30	48			48	48
6	39	I-35E	2.0		96	20	48				48
7	8	I-694/94	7.4		96	20				48	48
7	26	I-35E	13.0		48	10	48				
8	9	I-694/94	3		96	20				48	48
9	10	I-494	5		48	10					48
9	46	I-94	7		48	10				48	48
10	11	I-494	3.7		48	10					48
11	12	I-494	4.0		48	10					
12	13	I-494	4.3		48	10			48		
12	46	I-35E	8		144	30		48	48		48
12	47	I-35E	7		48	10		48			
13	14	I-494	1		48	10			48		
14	15	I-494	2.5		48	10			48		
15	16	I-494	2.7		48	10			48		
16	17	I-494	2.5		96	20		48	48		
16	42	MN 100	2.2		96	20		48	48		
17	52	I-169	18		48	10		48			
21	22	I-494	4.1		96	20			48	48	
21	31	I-394	3.5		96	20			48	48	
26	54	I-35	22		48	10	48				
30	32	MN 100		2.0	48	10			48		
31	32	I-394	2.5		96	20			48	48	
32	33	I-394	2.8		96	20		48		48	
32	42	MN 100	6.1		96	20		48	48		
33	34	I-94	2.0		192	40	48	48	48	48	
34	35	I-94	1.0		192	40	48	48	48	48	
35	37	I-94	3.0		240	50	48	48	48	48	48
35	38	I-35W	4.5		48	10					48
37	46	I-94	6		240	50	48	48	48	48	48



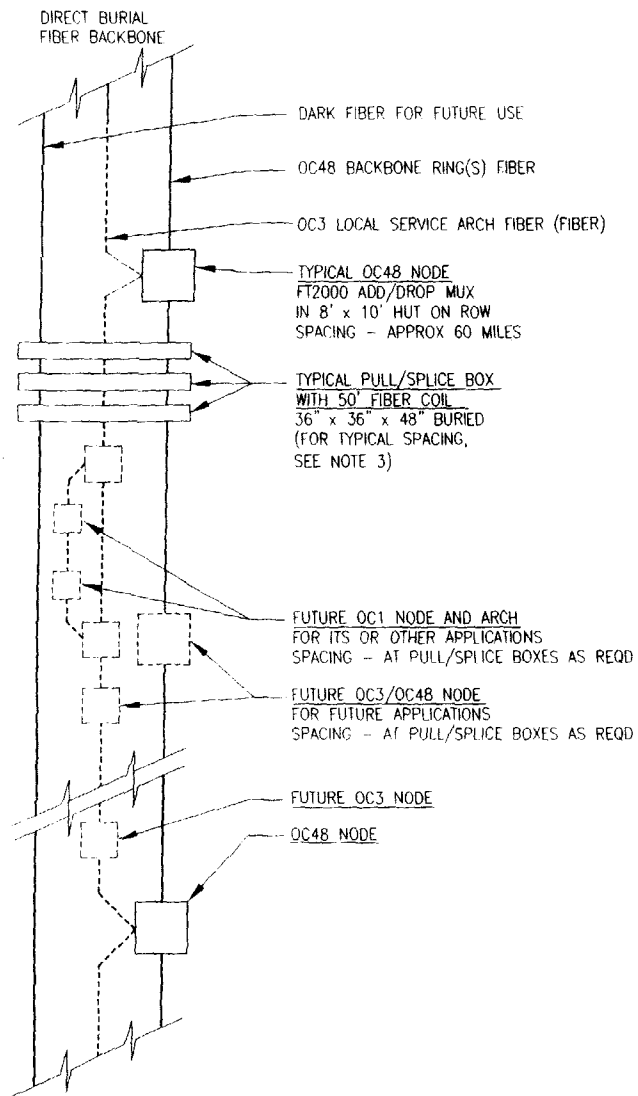


STATE OF MINNESOTA

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1
CAPACITY NODE)

2
CAPACITY NODE)



(DISASTER RECOV.) U OF M	METRO A	STS-48	STS-4
(DISASTER RECOV.) U OF M	METRO B	STS-48	STS-4
(DISASTER RECOV.) U OF M	METRO C	STS-48	STS-1

ROCHESTER	SOUTH	STS-3	STS-1	C
ST. CLOUD	NORTH	STS-3	STS-1	C
THIEF RIVER FALLS	NORTH	STS-3	STS-1	C
U OF M MINNEAPOLIS	METRO B	STS-12	STS-3	B
WILLMAR	NORTH	STS-3	STS-1	C
TOTAL	—	STS-45	STS-14	—

LEGEND FOR STATE

- U.S. HIGHWAY
- INTERSTATE HIGHWAY
- STATE ROADS
- COUNTY ROAD
- AIRPORTS
- PHASE 1 ROUTE
- OPTIONAL PHASE 1 ROUTE
- TYPICAL PHASE 2 ROUTE
- MN DOT OFFICE
- MNET OFFICE
- PULL/SPLICE BOX
- HUT
- CEV (BELOW GRADE CONTROLLED ENVIRONMENT VAULT)
- PEDESTAL
- MILEAGE MARKER
- OC48 NODE
- OC12 NODE
- OC3 NODE
- REST AREA
- TIC TRAVEL INFORMATION CENTER

DESIGN NOTES:

1. NODES WILL BE LOCATED IN THE STATE OFFICE, HUT, OR CEV AS NOTED ON THE DRAWING. REFERENCE THE METRO MAP AND CITY VICINITY MAPS FOR ADDITIONAL DETAIL ROUTING AND LOCATION INFORMATION.
2. SPURS WILL BE CONFIGURED AS COLLAPSED RINGS WITH ALL FIBER IN THE SAME SHEATH.
3. PULL BOX SPACING NOT TO EXCEED 2 MILES IN METRO AREAS AND 4 MILES IN RURAL AREAS. PULL BOXES, HUTS, OR CEV'S WILL BE LOCATED AT REST STOPS, TRAVEL INFORMATION CENTERS, AND THE ALBERTVILLE MnROAD SITE AS REQUIRED BY THE AGREEMENT.
4. PULL BOXES, HUTS, OR CEV'S MAY ALSO BE LOCATED AT OR NEAR MAJOR INTERSECTIONS, MAJOR EXCHANGES, MnDOT TRUCK STATIONS, STATE PATROL OFFICES, RWIS STATIONS, AND WEIGH STATIONS ADJOINING THE ROUTE. PULL BOXES, HUTS AND CEV'S WILL BE LOCATED ON THE RIGHT OF WAY WHENEVER POSSIBLE SUBJECT TO MN DOT APPROVAL.
5. STATE FIBER COUNT (DARK FIBER) AND STATE CAPACITY (LIT FIBER) AS SHOWN IN THE SCHEDULE OF DEPLOYMENT IS AS REQUIRED BY THE AGREEMENT. PULL BOXES FOR REST AREAS, TRAVEL INFORMATION CENTERS, AND THE ALBERTVILLE MnROAD SITE ARE AS REQUIRED BY THE AGREEMENT. ALL OTHER DESIGN INFORMATION SUCH AS, BUT NOT LIMITED TO, NODE LOCATIONS, NODE CAPACITY LEVELS, AND ROUTING, IS SHOWN FOR ILLUSTRATION AND IS SUBJECT TO MODIFICATION, CHANGE, OR RELOCATION DURING DETAIL DESIGN OR DURING CONSTRUCTION.

DETAIL A
TYPICAL ARCHITECTURE

STONE & WEBSTER PROPRIETARY

EXHIBIT A

MINNESOTA STATE MAP

MINNESOTA FIBER OPTIC
BACKBONE PROJECT
STATE OF MINNESOTA

SUMMARY

SOUTH RING	NORTH SPURS	SOUTH SPURS
516	4@249	1@64
OC48	—	—
12	0	0
0	6	2
2	5	1

) SEGMENTS)

RURAL FIBER DEPLOYMENT SCHEDULE

SEGMENT	FROM/TO	MILES		FIBER COUNT	STATE FIBER COUNT	RING	DETAIL
		E-ROW	NE-ROW				
1	LAKEVILLE TO OWATONNA (I-35)	58		48	10	SOUTH	A
2	MONTICELLO TO ST. CLOUD (I-94)	44		48	10	NORTH	A
3	MINNEAPOLIS/ST PAUL METRO AREA	—	—	SEE DETAILED METRO MAP	—	—	—
4	WORTHINGTON TO ROCHESTER (I-90)	184		48	10	SOUTH	A
5	ST. CLOUD TO MOORHEAD (I-94)	175		48	10	NORTH	A
6	NORTH BRANCH TO DULUTH (I-35)	129		48	10	NORTH	A
7	ROCHESTER TO OWATONNA (US14)		47	48	10	SOUTH	A
8	WORTHINGTON TO JORDAN (MN60, US169)		156	48	10	SOUTH	A
9	MOORHEAD TO DETROIT LAKES (US10)		45	48	10	SPUR	NOTE 2
10	MOORHEAD TO EAST GRAND FORKS (US75, MN220)		79	48	10	NORTH	A
11	FERGUS FALLS TO WILLMAR (US59, MN9, US12)		106	48	10	SPUR	NOTE 2
12	ST. CLOUD TO BRAINERD (US10, MN371)		70	48	10	SPUR	NOTE 2
13	WORTHINGTON TO MARSHALL (US59)		64	48	10	SPUR	NOTE 2
14	DULUTH TO HIBBING (US53)		90	48	10	NORTH	A
15	EAST GRAND FORKS TO BEMIDJI (US2)		113	48	10	NORTH	A
16	BEMIDJI TO HIBBING (US2)		112	48	10	NORTH	A
17	MARCOUX TO THIEF RIVER FALLS (MN32)		28	48	10	SPUR	NOTE 2
—	TOTAL	590	910	—	—	—	—

SCHEDULE OF MNDOT OFFICE CAPACITY

OFFICE	RING	NODE CAPACITY	STATE CAPACITY	DETAIL
BEMIDJI	NORTH	STS-3	STS-1	C
BRAINERD	NORTH	STS-3	STS-1	C
CROOKSTON	NORTH	STS-3	STS-1	B
DETROIT LAKES	NORTH	STS-3	STS-1	B
DULUTH	NORTH	STS-3	STS-1	C
GOLDEN VALLEY	METRO A	STS-3	STS-1	B
MANKATO	SOUTH	STS-3	STS-1	C
MARSHALL	SOUTH	STS-3	STS-1	C
MORRIS	NORTH	STS-3	STS-1	B
OAKDALE	METRO B	STS-3	STS-1	B
OWATONNA	SOUTH	STS-3	STS-1	B
ROCHESTER	SOUTH	STS-3	STS-1	C
ROSEVILLE (WATERS EDGE)	METRO C	STS-3	STS-1	B
ST. CLOUD	NORTH	STS-3	STS-1	C
VIRGINIA	NORTH	STS-3	STS-1	B
WILLMAR	NORTH	STS-3	STS-1	C
WINDOM	SOUTH	STS-3	STS-1	B
TOTAL	—	STS-51	STS-17	—

SCHEDULE OF NETWORK OPERATIONS HUB CAPACITY

LOCATION	RING	NODE CAPACITY	STATE CAPACITY
COB	NORTH	STS-48	STS-17
COB	SOUTH	STS-48	STS-8
COB	METRO A	STS-48	STS-1
COB	METRO B	STS-48	STS-4
COB	METRO C	STS-48	STS-1
U OF M (DISASTER RECOV.)	NORTH	STS-48	STS-17
U OF M	SOUTH	STS-48	STS-8

SCHEDULE OF MNET OFFICE CAPACITY

OFFICE	RING	NODE CAPACITY	STATE CAPACITY	DETAIL
BEMIDJI	NORTH	STS-3	STS-1	C
BRAINARD	NORTH	STS-3	STS-1	C
DULUTH	NORTH	STS-3	STS-1	C
HIBBING	NORTH	STS-3	STS-1	B
MANKATO	SOUTH	STS-3	STS-1	C
MARSHALL	SOUTH	STS-3	STS-1	C
MOORHEAD	NORTH	STS-3	STS-1	B

ROUTE
Y, TYP.)

TO
JB

NODE OR HUB
ELECTRONICS
LOCATED
IN HUT, CEV,
OR STATE
OFFICE
EQUIPMENT
SPACE

IN CONDUIT IN HIGH RISK AREA

ROUTE

ALL B

NODE LOCATION
ATIC DIAGRAM

Exhibit A
Network Architecture Supporting Tables

Table A: MnDOT Offices Locations And Capacities Included In Phase 1

	<u>Name</u>	<u>District</u>	<u>Address</u>	<u>City</u>	<u>State</u>	<u>Zip</u>	<u>State Capacity</u>
1	Brainerd DOT	3A	1991 Industrial Park Rd.	Baxter	MN	56401	STS-1
2	Bemidji DOT	2A	401 Paul Bunyan Drive	Bemidji	MN	56619	STS-1
3	Crookston DOT	2B	1320 Sunflower	Crookston	MN	56718	STS-1
4	Detroit Lakes DOT	4A	1000 West Highway 10	Detroit Lakes	MN	56501	STS-1
5	Duluth DOT	1A	1123 Mesaba Ave	Duluth	MN	55811	STS-1
6	Golden Valley DOT	Metro	2055 North Lilac Drive	Golden Valley	MN	55422	STS-1
7	Mankato DOT	7A	501 South Victory Drive	Mankato	MN	56001	STS-1
8	Marshall DOT	8B	1800 East College Drive	Marshall	MN	56258	STS-1
9	U of M Minneapolis (Note 2)	--	90 SE Church Street	Minneapolis	MN	55455	Note 2
10	Morris DOT	4B	610 South Highway 9	Morris	MN	56267	STS-1
11	Oakdale DOT	Metro	3487 Hadley Avenue North	Oakdale	MN	55128	STS-1
12	Owatonna DOT	6B	1010 21st Avenue NW	Owatonna	MN	55060	STS-1
13	Rochester DOT	6A	2900 48th Street NW	Rochester	MN	55903-6177	STS-1
14	Waters Edge DOT	Metro	1500 West Conuty Road B2	Roseville	MN	55113	STS-1
15	St Cloud DOT	3B	3725 12th Street, North	St Cloud	MN	56302	STS-1
16	St. Paul COB (Note 1)	--	658 Cedar Street	St Paul	MN	55155	Note 1
17	Virginia DOT	1B	101 N. Hoover Road	Virginia	MN	55792	STS-1
18	Willmar DOT	8A	2505 Transportation Road	Willmar	MN	56201	STS-1
19	Windom DOT	7B	County Road 28	Windom	MN	56101	STS-1

Notes:

1. COB Location will be shared with MNet as the Network Normal Operations Center. See Table C for capacities.
2. U of M Minneapolis Location will be shared with MNet as the Network Disaster Recovery Center. See Table C for capacities.

Exhibit A
Network Architecture Supporting Tables

Table B: MNet Locations and Capacities Included in Phase 1

<u>MNet Location</u>	<u>Address</u>	<u>City</u>	<u>State</u>	<u>Zip</u>	<u>Building</u>	<u>State Capacity</u>
1 Bemidji State University	1500 Birchmont Drive NE	Bemidji	MN	56601	Deputy Hall Room 55	STS-1
2 Brainerd RTC	1777 Highway 18 East	Brainerd	MN	56401	Phone Room	STS-1
3 Duluth Government Services Center	320 West 2nd Street	Duluth	MN	55802	4th Floor Computer Room 401	STS-1
4 Hibbing Community College	1515 East 25th Street	Hibbing	MN	55746	Planetarium	STS-1
5 Mankato State University	South Road and Ellis Avenue	Mankato	MN	56002	Morris Hall Computer Room	STS-1
6 Southwest State University	1500 State Street	Marshall	MN	56258	PE Building Room AC105	STS-1
7 U of M Minneapolis (Normal)	90 SE Church Street	Minneapolis	MN	55455		STS-3
8 U of M Minneapolis (Note 2)	90 SE Church Street	Minneapolis	MN	55455		Note 2
9 Moorhead State University	1104 7th Avenue South	Moorhead	MN	56563	Livingston Lord Library Computer Room	STS-1
10 University Center Rochester	859 30th Avenue SE	Rochester	MN	55902	Phone Room Adjacent to elect room, basement-gym dock	STS-1
11 St. Paul COB (Note 1)	658 Cedar Street	St Paul	MN	55155		Note 1
12 St. Cloud State University	701 First Ave South	St. Cloud	MN	56301	Stuart Hall Vault Room	STS-1
13 Northland Community College	1101 Highway 1 East	Thief River Falls	MN	56701	Phone Room	STS-1
14 Willmar RTC	1550 Highway 71 NE	Willmar	MN	56201	Phone Room - Basement across from the keyed elevator	STS-1

Notes:

1. COB Location will be shared with MnDOT as the Network Normal Operations Center. See Table C for capacities.
2. U of M Minneapolis Location will be shared with MnDOT as the Network Disaster Recovery Center. See Table C for capacities.

Exhibit A
Network Architecture Supporting Tables

Table C: Operations Centers Nodes and State Capacities Included in Phase 1

<u>MNet Location</u>	<u>Ring</u>	<u>Address</u>	<u>City</u>	<u>State</u>	<u>Zip</u>	<u>Building</u>	<u>State Capacity</u>
1 St. Paul COB (Note 1)	North	658 Cedar Street	St Paul	MN	55155		STS-17
2 St. Paul COB (Note 1)	South	658 Cedar Street	St Paul	MN	55155		STS-8
3 St. Paul COB (Note 1)	Metro A	658 Cedar Street	St Paul	MN	55155		STS-1
4 St. Paul COB (Note 1)	Metro B	658 Cedar Street	St Paul	MN	55155		STS-4
5 St. Paul COB (Note 1)	Metro C	658 Cedar Street	St Paul	MN	55155		STS-1
6 U of M Minneapolis (Note 2)	North	90 SE Church Street	Minneapolis	MN	55455		STS-17
7 U of M Minneapolis (Note 2)	South	90 SE Church Street	Minneapolis	MN	55455		STS-8
8 U of M Minneapolis (Note 2)	Metro A	90 SE Church Street	Minneapolis	MN	55455		STS-1
9 U of M Minneapolis (Note 2)	Metro B	90 SE Church Street	Minneapolis	MN	55455		STS-4
10 U of M Minneapolis (Note 2)	Metro C	90 SE Church Street	Minneapolis	MN	55455		STS-1

Notes:

1. COB Location will be shared with MNet and MnDOT as the Network Normal Operations Center.
2. U of M Minneapolis Location will be shared with MNet and MnDOT as the Network Disaster Recovery Center.

Exhibit A
Network Architecture Supporting Tables
Table D: Rest Areas and Travel Information Centers Included in Phase 1

	<u>Name</u>	<u>Highway</u>	<u>Mile Marker</u>	<u>Type</u>	<u>Direction</u>	<u>Location</u>	<u>State Interface</u>
1	Fishers Landing	US-2	12.0	TIC	--	9.0 miles east of Grand Forks	Pull/Splice Box
2	Oak Lake	US-2	59.0	RA	--	1.0 mile east of Jct. US-59	Pull/Splice Box
3	Cass Lake	US-2	130.7	RA	--	At Cass Lake	Pull/Splice Box
4	Heath Creek	I-35	68.0	RA	NB	9.0 miles north of Faribault	Pull/Splice Box
5	New Market	I-35	75.4	RA	SB	0.5 miles south of Scott Co line	Pull/Splice Box
6	Forest Lake	I-35	131.2	RA	SB	0.8 miles south of CSAH 2	Pull/Splice Box
7	Goose Creek	I-35	153.6	RA	NB	1.5 miles north of Harris	Pull/Splice Box
8	Kettle River	I-35	198.0	RA	NB	5.0 miles north of Sandstone	Pull/Splice Box
9	General Andrews	I-35	208.4	RA	SB	2.0 miles NE of Willow River	Pull/Splice Box
10	Culkin	I-35	225.6	RA	NB	1.0 mile south of Mahtowa	Pull/Splice Box
11	Thompson Hill	I-35	250.0	TIC	SB	At the JCT of I-35 and US-2	Pull/Splice Box
12	Anchor Lake	US-53	50.0	TIC	--	9.0 miles south of Eveleth	Pull/Splice Box
13	Watonswan River	MN-60	--	RA	--	5.0 miles east of St. James	Pull/Splice Box
14	Clear Lake	I-90	69.0	RA	EB	4.2 Miles west of Jackson	Pull/Splice Box
15	Des Moines River	I-90	72.0	RA	WB	1.5 miles west of US-71	Pull/Splice Box
16	Blue Earth	I-90	119.0	RA	EB	1.0 miles west of US-169	Pull/Splice Box
17	Blue Earth	I-90	119.0	RA	WB	1.0 miles west of US-169	Pull/Splice Box
18	Hayward	I-90	163.0	RA	EB	2.2 miles east of I-35	Pull/Splice Box
19	Oakland Woods	I-90	171.0	RA	WB	1.25 miles west of CSAH 34	Pull/Splice Box
20	Highforest	I-90	202.0	RA	EB	3.1 miles sw of Highforest	Pull/Splice Box
21	Moorhead	I-94	1.9	TIC	EB	0.34 miles west of US-52	Pull/Splice Box
22	Lake Iverson	I-94	60.0	RA	EB	8.0 miles se of Fergus Falls	Pull/Splice Box
23	Hansei Lake	I-94	69.0	RA	WB	0.4 miles se of US-59	Pull/Splice Box
24	Lake Lakota	I-94	99.5	RA	EB	1.15 miles NW of TH27	Pull/Splice Box
25	Burgen Lake	I-94	105.5	RA	WB	1.5 miles east of TH 29	Pull/Splice Box
26	Spunk Lakes	I-94	151.7	RA	EB	1.5 miles west of Avon Interchange	Pull/Splice Box
27	Spunk Lakes	I-94	151.7	RA	WB	1.5 miles west of Avon Interchange	Pull/Splice Box
28	Fulter Lake	I-94	177.5	RA	WB	1.0 mile east of the Stearns Co line	Pull/Splice Box
29	Enfield	I-94	186.9	RA	EB	6.0 miles west of TH25	Pull/Splice Box
30	Elm Creek	I-94	215.5	RA	EB	2.0 miles NW of the Jct with I-494	Pull/Splice Box
31	Minnesota Valley	US-169	79.5	RA	--	1.0 miles north of LeSueur	Pull/Splice Box
32	Sioux Historic Site	US-169	--	LOC	--	North of St Peter	Pull/Splice Box
33	Nashwauk	US-169	--	LOC	--	Jct Hwy 65 and 169	Pull/Splice Box
34	Hibbing	US-169	--	LOC	--	Iron World	Pull/Splice Box
35	Hawley	US-10	--	LOC	--	Hawley	Pull/Splice Box
36	Bemidji	MN-371	--	RA	--	MN-371 and 5th street	Pull/Splice Box
37	Ball Club Lake	US-2	--	RA	--	Ball Club Lake	Pull/Splice Box
38	Fort Ripley	MN-371	--	RA	--	Fort Ripley	Pull/Splice Box
39	Pine City (Future)	I-35	--	RA	SB	North of Pine City	Pull/Splice Box

Notes:

1. RA = Rest Area
2. TIC = Travel Information Center
3. LOC=Local Facility

Exhibit A
Network Architecture Supporting Tables

Table E: Rest Areas and Travel Information Centers Included in Phase 1-Optional Route

	<u>Name</u>	<u>Highway</u>	<u>Mile Marker</u>	<u>Type</u>	<u>Direction</u>	<u>Location</u>	<u>State Interface</u>
1	Albert Lea	I-35	1.0	TIC	NB	8.0 miles south of Albert Lea	Pull/Splice Box
2	Straight River	I-35	35.0	RA	NB	7.0 miles south of Owatonna	Pull/Splice Box
3	Straight River	I-35	35.0	RA	SB	7.0 miles south of Owatonna	Pull/Splice Box
4	Beaver Creek	I-90	0.0	TIC	EB	MN/SD state line	Pull/Splice Box
5	Adrian	I-90	24.5	RA	EB	2.0 miles west of Adrian	Pull/Splice Box
6	Adrian	I-90	24.5	RA	WB	2.0 miles west of Adrian	Pull/Splice Box
7	Marion	I-90	220.0	RA	WB	3.5 miles east of US-52	Pull/Splice Box
8	Enterprise	I-90	244.0	RA	EB	10.0 miles east of St. Charles	Pull/Splice Box
9	Dresbach	I-90	276.5	TIC	WB	Jct of I-90 and US-61 at Dresbach	Pull/Splice Box
10	St Croix	I-94	257.8	TIC	WB	2.76 miles west of the St Croix River	Pull/Splice Box

Notes:

1. RA = Rest Area
2. TIC = Travel Information Center

Exhibit A
Network Architecture Supporting Tables

Table F: MnRoad Locations Included in Phase 1

	<u>MnRoad Location</u>	<u>Highway</u>	<u>Mile Marker</u>	<u>Address</u>	<u>City</u>	<u>State</u>	<u>Zip</u>	<u>State Interface</u>
1	MnRoad Test Site	I-94	201.0	--	Albertville	MN	--	Pull/Splice Box

Table G: MnRoad Locations Included in Phase 1 Optional

	<u>MnRoad Location</u>	<u>Highway</u>	<u>Mile Marker</u>	<u>Address</u>	<u>City</u>	<u>State</u>	<u>Zip</u>	<u>State Interface</u>
1	Office of Minnesota Road Research	--	--	1400 Gervais Ave	Maplewood	MN	55109	Pull/Splice Box

Exhibit A
Network Architecture Supporting Tables

Table H: Freeway Sections Included in Phase 1 and Optional Phase 1 Routes

	<u>Route</u>	<u>From Mile Marker (or Reference)</u>	<u>To Mile Marker (or Reference)</u>	<u>Miles</u>	<u>From Location</u>	<u>To Location</u>	<u>Phase</u>
1	I-35	000.000	259.599	220.457	Iowa State Line	Duluth	
1a	I-35				Iowa State Line	Owatonna	Phase 1 Opt.
1b	I-35				Owatonna	South Jct I-35W and I-35E	Phase 1
1c	I-35				North Jct I-35W and I-35E	Duluth, 26th Ave East	Phase 1
2	I-35E	088.267	127.420	39.340	South Jct I-35W and I-35E	North Jct I-35W and I-35E	Phase 1
3	I-35W	000.000	041.743	41.778	South Jct I-35W and I-35E	North Jct I-35W and I-35E	
3a	I-35				South Jct I-35W and I-35E	West Jct I-94	Phase 1 Opt.
3b	I-35				West Jct I-94	Jct MN-36	Phase 1
3c	I-35				Jct MN-36	North Jct I-35W and I-35E	Phase 1 Opt.
4	I-90	000.000	276.891	275.701	SD State Line	WI State Line	
4a	I-90				SD State Line	Worthington	Phase 1 Opt.
4b	I-90				Worthington	Rochester	Phase 1
4c	I-90				Rochester	WI State Line	Phase 1 Opt.
5	I-94	000.000	259.727	259.224	ND State Line	WI State Line	
5a	I-94				ND State Line	East Jct I-694	Phase 1
5b	I-94				East Jct I-694	WI State Line	Phase 1 Opt.
6	I-394	000.000	009.735	9.735	Jct 494, Minnetonka	Washington Ave., Minneapolis	Phase 1
7	I-494	000.000	027.973	27.993	East Bridge over Minn. River, Blmtn	Jct I-94, Maple Grove	
7a	I-494				East Bridge over Minn. River, Blmtn	Jct 169, Eden Prairie	Phase 1
7b	I-494				Jct 169, Eden Prairie	Jct I-394, Minnetonka	Phase 1 Opt.
7c	I-494				Jct I-394, Minnetonka	Jct I-94, Maple Grove	Phase 1
8	I-494	058.187	072.886	14.863	Jct I-694, Woodbury	East Bridge over Minn. River, Blmtn	Phase 1
9	I-535	000.000	001.571	1.571	WI State Line	I-35, Duluth	Phase 1 Opt.
10	I-694	034.197	058.187	23.292	Jct 94, Brooklyn Center	Jct I-94, Woodbury	Phase 1
11	US-10	223.653	233.149	9.492	0.6 miles north of US-169 in Anoka	MN-47 in Coon Rapids	Phase 1 Opt.
12	US-12	152.661	157.000	4.497	4.5 miles west of I-494 in Wayzata	I-494 in Minnetonka	Phase 1 Opt.
13	US-52	121.679	131.014	9.335	MN-55 in Inver Grove Heights	I-94 in St. Paul	Phase 1 Opt.

Exhibit A
Network Architecture Supporting Tables

Table H (cont.): Freeway Sections Included In Phase 1 and Optional Phase 1 Routes

14	US-169	107.273	139.572	30.611	Begin Shakopee Bypass	CSAH 81 In Brooklyn Park	
14a	US-169				Begin Shakopee Bypass	Jct. I-494, Eden Prairie	Phase 1
14b	US-169				Jct. I-494, Eden Prairie	CSAH 81 In Brooklyn Park	Phase 1 Opt.
15	US-212	159.429	162.482	3.053	I-494 In Eden Prairie	MN-62 In Eden Prairie	Phase 1 Opt.
16	MN-5	049.843	064.829	3.661	0.9 miles west of I-494 In Bloomington	Wheeler Street In St. Paul	Phase 1 Opt.
17	MN-36	000.000	006.838	6.844	I-35W In Roseville	US-61 In Maplewood	
17a	MN-36				I-35W In Roseville	I-35E In Little Canada	Phase 1
17b	MN-36				I-35E In Little Canada	US-61 In Maplewood	Phase 1 Opt.
18	MN-55	197.209	199.192	2.001	MN-62 In Minneapolis	MN-110 In Mendota Heights	Phase 1 Opt.
19	MN-62	103.592	111.475	7.683	I-494 In Eden Prairie	West Jct of I-35W In Richfield	Phase 1 Opt.
20	MN-62	112.032	115.942	3.910	East Jct of I-35W In Richfield	MN-62 In Minneapolis	Phase 1 Opt.
21	MN-77	001.832	011.393	9.561	1.0 miles south of I-35E In Apple Valley	MN-62 In Minneapolis	Phase 1 Opt.
22	MN-100	000.000	006.698	6.602	I-494 In Bloomington	MN-55 In Golden Valley	Phase 1
23	MN-100	013.664	016.156	2.503	2.5 miles south of I-94 In Brooklyn Center	I-94 In Brooklyn Center	Phase 1 Opt.
24	MN-118	233.561	237.040	3.498	MN-65 In Blaine	I-35W In Mounds View	Phase 1 Opt.
25	MN-280	000.000	002.474	2.474	I-94 In St Paul	5.0 miles north of I-94 In St Paul	Phase 1 Opt.
26	MN-610	000.000	002.306	2.306	MN-610 In Brooklyn Park	US-10 In Coon Rapids	Phase 1 Opt.
27	US-52	046.505	059.629	13.524	Jct I-90, Rochester	3.5 miles north of west Jct with US-14	Phase 1 Opt.
28	US-14	130.030	133.822	3.764	Jct US-14 US-169, Mankato	Jct MN-22, Mankato	Phase 1 Opt.
29	US-212	111.015	118.987	8.033	0.9 mi. west of north Jct with US-71, Bemidji	2.0 mi. east of south Jct with US-71, Bemidji	Phase 1 Opt.
TOTAL			1049.526				

EXHIBIT A
Network Architecture; Narrative Descriptions

Operations Center

An operations center is to be configured to monitor and manage the Network on a continuous basis. The operations center should be designed, staffed, and equipped (hardware, software, process) appropriately to provide the following capabilities.

1. Continuous monitoring of alarms and Network performance twenty four hours a day, seven days a week.
2. The system should be capable of categorizing major (service affecting) and minor alarms and taking automated action (e.g. highlighting, sounding alarm, or initiating a page) as defined.
3. Allow for reporting of troubles via telephone (local or 800 number) and electronically via the Internet using Web tools. Reported troubles should be acknowledged by providing a ticket number.
4. An established process to track problems and escalate response to appropriate entities to meet service performance criteria.
5. An established process to dispatch field technicians and manage spare parts.
6. An established process and means to:
 - A. Request adds, moves, and changes electronically.
 - B. Track the status of adds, moves, and changes
7. Be designed and configured with appropriate equipment (hardware/software) to:
 - A. Allow real time status and performance monitoring of the State's capacity at COB St. Paul and the recovery site at U of M in Minneapolis.
 - B. Allow real time management and reconfiguration of the State's capacity by authorized State staff.
 - C. Allow electronic reporting and transfer of Network performance data for analysis.
8. The operations center must have test and diagnostics equipment to isolate various types of fiber facility and equipment problems (end to end, line, section, path).

Test Facility

The purpose of the test facility is to allow testing of new software releases, new hardware releases, new products, and new configurations in an environment that does not impact services provided by the operating network. Additionally, the test bed would allow development and verification of acceptance testing procedures.

The test bed must allow creation of various physical configurations (e.g. rings, spurs, bus, arches, interconnected rings, etc.) and include connection to the operations center. The test bed should include sufficient fiber facilities and equipment to be able to test Phase I deployment.

Initially the test bed and test network is to include: OC-48, OC-12, and OC-3 nodes with DS1 and DS3 interfaces. The equipment used in the test bed environment is not to be used in the operating network.

Appropriate space and environment should be provided to accommodate the equipment being deployed. Additional space should be planned to allow deployment of new equipment (e.g. customer premises, new products, etc.) that may be brought in periodically by the Company and the State for testing purposes. The test bed shall be accessible to the State.

The test bed and the test network should be deployed prior to installation of operating Network Equipment. The test bed should be used to stage and test equipment for the rest of the Network.

Ring Interconnections

The Network architecture shall provide for interconnection of the SONET rings. The interconnection shall:

1. Allow for end points on different rings to connect (transmit and receive specified bit rates) on a point to point basis in an efficient manner. The design must allow for full interconnection of capacity from one ring to another if required.
2. Provide M24 (DS0 to DS1) and M13 (DS1 to DS3) multiplexing and de-multiplexing and cross-connection across rings (DACS functionality) such that traffic originating from a single interface (e.g. DS3 or DS1) on a ring destined for multiple end points located on different rings can be delivered at those end points on a single interface or multiple interfaces. This capability is also referred to as traffic grooming or 3 x 1 x 0 cross connection.
3. Ring interconnect design should avoid single points of failure.
4. Ring interconnection architecture should allow for rerouting of traffic from COB to the University of Minnesota hub in the event of a disaster that renders COB site inoperative.
5. The network operation center should be able to remotely reconfigure traffic across rings (e.g. establish new paths or remove existing paths between end points on different rings) assuming that such reconfiguration does not require additional capacity or equipment on the rings affected.

Additional Network Architecture Related Items

1. Useful life of the installed optical fiber shall exceed 30 years.
2. State's dark fiber shall be accessible at MnDOT and MNet locations, huts, and pull boxes. The fiber shall be terminated on rack mounted termination panel with FC/PC type connectors with not more than 1 dB connection loss and not less than -30 dB return loss characteristics. Fibers shall have optical pigtails spliced on the ends by fusion method.
3. Notwithstanding any contrary Notes on the Exhibit A Maps, (a) the initial Network design shall consist of a minimum of five SONET rings each of which will have a minimum of OC48 capacity and (b) the five rings shall be deployed as shown on the Exhibit A Maps.

EXHIBIT B
Design and Construction Standards

MnDOT Manuals:

Road Design, Volumes I and II	Bituminous
Technical	Concrete
Surveying and Mapping	Geotechnical and Pavement, Parts 1 and 2
Drainage	Maintenance
Standard Plates	State Aid
Bridge Construction	Traffic Engineering
Bridge Design	Uniform Traffic Control Devices
Bridge Standard Plans	Standard Signs
Bridge Details	Standard Plans
Bridge Maintenance	Utilities
Right of Way	Bikeway Design
Contract Administration	Structural Metals
Grading and Base	Project Managers Handbook, Volumes 1-4

MnDOT Specifications

Standard Specifications for Construction, 1995
CADD Specifications, Volume II
Mapping Specifications
Special Provisions Standard Write Ups (SP5's)

MnDOT Publications

Technical Memoranda
Sample Plans (use as a guide)
Design Scenes (use as a guide)
Materials Control Schedule

AASHTO Roadway Design Guide

FHWA Publications

Contract Administration Core Curriculum Participants Manual and Reference Guide 1996

MnDOT Policy Manual 90-1-G-1 (Guideline, Highways No. 90-1-G-1, Permits for Accommodation of Utilities on Highway Right of Way, dated July 27, 1990), subject to exclusions per §2.75 of Agreement

MnDOT Policy Manual 90-1-P-1 (Highways No. 90-1-P-1, Procedures for Accommodation of Utilities on Highway Right of Way, dated July 27, 1990), subject to exclusions per §2.75 of Agreement

MnDOT Temporary Traffic Control Zone Layouts Field Manual, April 1995

MnDOT Work Zone Specifications

MnDOT Lane Closure Manual

MnDOT Metro Division Traffic Maintenance and Control (SP5M-10)

MnDOT Utility Permit Application Form (Long Form No. 2525)

MnDOT Permits - Special Provisions

Bellcore Standard LP-CSP-OY7101

National Electric Code (latest edition)

EXHIBIT C
Preliminary Performance Standards

Lighted Fiber Capacity

1. Transport capacity shall be accessible to the State at any point where electronic access is available on lighted fiber.
2. Initial as well as future capacity shall be accessible using a variety of transmission levels and interfaces. These include:
 - A. DS1 using V.35, DSX-1, or RJ48C interface
 - B. DS3 using electrical or optical interface
 - C. OCn (OC3, OC3c, OC12, OC12c)
 - D. Native LAN using 10BaseT interface
 - E. Video using MPEG-2 standard

All capacity (initial and future) shall be delivered through a single terminating system to the extent practical.

3. Line coding for DS1 circuits shall be bipolar AMI or B8ZS as requested on a line basis. Line coding for DS3 circuits shall be B3ZS. For OCn transmission applicable SONET standards shall be followed. The network shall support Extended Super Frame (ESF) format for DS1 circuits.
4. Initially MnDOT and MNet (except COB and UofM Mpls) sites shall be configured with two DS1 and one DS3 interface. Each of the COB and UofM Mpls sites shall have sufficient number of DS1 and DS3 interfaces to connect to the remote MnDOT and MNet sites. For the OC3 capacity between COB and U of M Mpls, three DS3 interfaces shall be provided at each site.
5. DS1 circuits shall achieve or exceed following performance measures:
Ref: US West Technical Publication 77375
 - A. 98.75 % error free seconds and 1.25% errored seconds determined over a 24 hour period.
 - B. 99.925% availability where unavailability is defined as a Bit Error Rate of worse than 10^{-3} for a period of 10 consecutive seconds.
6. DS3 circuits shall achieve or exceed following performance objectives:
Ref: US West Technical Publication 77324

- A. 1% errored seconds with end to end service availability of 99.83% where unavailability is defined as a Bit Error Rate of equal to or worse than 10^{-3} in any one second interval.
 - B. Long term performance objective parameters as further described in ANSI T1.503-1989.
7. Except for mutually agreed upon scheduled maintenance, OCn services shall achieve or exceed the following performance objectives:
Ref: US West Technical Publication 77346
- A. .25% errored seconds (ES) and 0.035% severely errored seconds (SES).
 - B. 99.83% availability where unavailability is defined as more than 10 consecutive SES.
 - C. Fewer than 9 short interruption events per month.
8. End to end circuit performance for DS1 and DS3 capacity shall exhibit Bit Error Rate (BER) of 1×10^{-11} or better at the OC-48 interface and 1×10^{-9} or better at the OC-3 and OC-12 interfaces.
9. The Network shall be designed to automatically recover from failures. The recovery (Automatic Protect Switching) on a single ring shall be detected in 10 milliseconds or less and switching shall occur within 50 milliseconds of detection.
10. The Network shall be able to reroute traffic on State capacity from COB to UoM Site in real time (less than a minute) upon instructions from Network operations center.
11. The Network must have a stable primary and secondary clock source to synchronize timing. The Network shall be able to interface to carrier facilities at DS1 and DS3 interfaces and accept carrier provided timing. Interfacing with carrier at OCn level shall be according to SONET Mid-Span connection standards.
12. Any end point on the Network shall be able to connect to any other end point without regard to its physical location on a particular SONET ring or segment.
13. The Network shall be able to groom traffic and provide $3 \times 1 \times 0$ cross connect capability. For example, traffic originating from a single interface (e.g. DS3 or DS1) on a ring destined for multiple end points located on different rings can be delivered at those end points on a single interface or multiple interfaces.

Dark Fiber Capacity

1. At a minimum, the fiber provided shall be single mode, non-dispersion shifted type (also called standard fiber) suitable for operation in 1310nm and 1550nm modes. Fiber capable of wave division multiplexing is preferred.